

Personality profile in type I alcoholism: long duration of alcohol intake and low serotonergic activity are predictive factors of anxiety proneness

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Summary. The aim of the present study was to further investigate personality profiles in male type I alcohol-dependent subjects ($n = 33$), in relation to central serotonergic neurotransmission, history of excessive alcohol consumption and present use of tobacco. Central serotonergic neurotransmission was assessed by the prolactin (PRL) response to D-fenfluramine. By using the Temperament and Character Inventory and the Karolinska Scales of Personality, all subjects self-rated their personality profile. The results showed that individuals with low PRL response and long duration of excessive alcohol consumption had significantly higher anxiety proneness, and that years of excessive alcohol consumption was the strongest predictor. Long duration of excessive alcohol consumption thus appears to have an influence on personality traits in male type I alcohol-dependent individuals and these personality traits may therefore be a consequence of, rather than preceding, alcoholism in these individuals.

Keywords: Personality, serotonin, alcohol, tobacco.

Introduction

Dysfunction in central serotonergic neurotransmission has been demonstrated in several clinical studies of individuals with heavy alcohol consumption (Le Marquand et al., 1994). Thus, reduced cerebrospinal fluid (CSF) concentrations of the serotonin (5-hydroxytryptamine; 5-HT) metabolite 5-hydroxyindoleacetic acid (5-HIAA) have been found in alcohol-dependent individuals who have been abstinent from 2 weeks to 3 months (Ballenger et al., 1979; Banki, 1981; Borg et al., 1985). Furthermore, several neuroendocrine studies have demonstrated reduced hormonal responses to serotonin-releasing agents or receptor agonists in heavy drinkers (Balldin et al., 1994a) as well as in abstinent alcohol-dependent individuals (Buydens-Branchey et al., 1997; Farren et al., 1995; Lee and Meltzer, 1991).

The reasons for the reduced central serotonergic metabolism and neurotransmission in alcohol-dependent individuals are not known with certainty, but some possible factors have been discussed. It has been suggested that

individuals with early onset of excessive alcohol consumption may have a pre-existing reduction in the central serotonergic neurotransmission (Virkkunen and Linnoila, 1990; Fils-Aime et al., 1996; Berggren et al., 2002). Furthermore, strong support for this notion of constitutionally low serotonergic neurotransmission is given by studies of nonhuman primates, which show that subjects with low CSF 5-HIAA have early onset of excessive alcohol consumption (Higley and Bennett, 1999). Moreover, maternal and paternal genetic influences, exacerbated by early rearing experiences (parental deprivation) appear to play major roles for low central serotonergic neurotransmission in nonhuman primates (Higley and Bennett, 1999). Besides the possibility of a pre-existing reduction in central serotonergic neurotransmission another possible factor for reduced central serotonergic neurotransmission has been discussed in recent years. For example, Heinz et al. (1998) found a reduction of about 30 percent of brainstem serotonin transporters in type I alcohol-dependent individuals and this reduction was associated with life-time alcohol consumption, suggesting that chronic alcohol intoxication reduces central serotonin transporter density. In a subsequent study, Heinz et al. (2000) reported that alcohol-dependent individuals who were homozygous carriers of the long allele of the 5HTT promoters were selectively more vulnerable to the neurotoxic effects on serotonin transporters of long-term excessive alcohol consumption. In an earlier study of ours (Berggren et al., 2002) it was also found that longer duration of excessive alcohol consumption was associated with more pronounced reduction in central serotonergic neurotransmission, as assessed by the prolactin (PRL) response to D-fenfluramine. This finding may suggest that long-term excessive alcohol consumption causes a reduction in central serotonergic neurotransmission, possibly by a toxic effect of alcohol on serotonin neurons (Berggren et al., 2002). This reduction in central serotonergic neurotrans-

mission may, however, be reversible after several years of abstinence (Gotjen et al., 2002).

In recent years the influence of tobacco and nicotine on central serotonergic neurotransmission has also been discussed. Thus, Anthenelli and Maxwell (2000) reported no difference in the PRL response to D,L-fenfluramine, used as an index of central serotonergic neurotransmission, between controls, type I alcoholics, type II alcoholics and alcoholics with antisocial personality disorders, whereas cigarette smokers had a reduced PRL response in comparison to nonsmokers. In another recent study of ours (Berggren et al., 2003) we also found that tobacco-using (cigarette smokers and users of smokeless tobacco, i.e. snuffers) alcoholics had reduced central serotonergic neurotransmission, as assessed by the PRL response to D-fenfluramine, in comparison to tobacco-nonusing alcoholics. These studies thus shows that in the evaluation of central serotonergic neurotransmission in alcohol-dependent individuals the influence of tobacco use must be taken into consideration.

Central serotonergic neurotransmission has also been associated with certain profiles of personality (Marlowe, 1993). One commonly used self-rating scale for assessing personality profile is the Temperament and Character Inventory (TCI). This inventory was developed by Cloninger (1994) on the basis of his *Biosocial Model of Personality* (Cloninger, 1986, 1988). TCI is designed to measure the neurobiological bases of personality (temperament) in combination with the environmental bases of personality (character). Concerning the hypothesis that there exists a relationship between certain neurotransmitter systems and personality profiles, it has been especially emphasised that the temperament dimension harm avoidance is linked to serotonergic activity. For example, in a study of healthy controls, it has been found that harm avoidance, as well as self directedness (a dimension of the character profile), was associated with platelet 5-HT₂

receptor sensitivity, used as an index of central serotonergic neurotransmission (Peirson et al., 1999). In another study of healthy controls, using a more direct assessment of central serotonergic neurotransmission (i.e. the PRL response to D-fenfluramine), Hennig et al. (2000) found a relationship between reduced central serotonergic neurotransmission and high values of harm avoidance. In a study investigating the relationship between personality and central serotonergic neurotransmission in alcohol-dependent men, Weijers et al. (2001) also found that low PRL response to DL-fenfluramine was associated with increased harm avoidance. Thus, these studies indicate that there exist a possible relationship between low serotonergic activity and anxiety proneness.

The aim of the present study was to further evaluate the relationship between central serotonergic neurotransmission, as assessed by the PRL response to D-fenfluramine, and personality, particularly the TCI dimension of harm avoidance, in alcohol-dependent men. Since we have, as mentioned above, found associations between central serotonergic neurotransmission and duration of excessive alcohol consumption (Berggren et al., 2002) and in relation to tobacco use (Berggren et al., 2003) the present study also investigated the influence on the temperament dimension harm avoidance on these variables. More specifically, the purpose of this study was to investigate whether harm avoidance is associated with low central serotonergic neurotransmission or with variables that also are associated with such low neurotransmission, i.e. long duration of excessive alcohol consumption or tobacco use.

Finally, we also investigated the relationships between the above mentioned variables and personality by using another scale for personality assessment, the Karolinska Scales of Personality (KSP; Schalling et al., 1987). KSP, as well as TCI, is constructed to measure stable personality traits and has been shown to correlate with neurotransmitters

(Schalling et al., 1987), which are assumed to be involved in vulnerability for psychiatric disorders. The foremost aim for using this personality test in the present study was that it differentiates psychic (cognitive, social anxiety, worrying, insecurity) from somatic (autonomic disturbances, vague distress and panic attacks) anxiety. This differentiation may be of importance since tobacco use has the paradoxical effect of simultaneously producing subjective calming and increasing sympathetic arousal (Pomerleau and Pomerleau, 1984), which may be reflected in reducing psychic anxiety and increasing somatic anxiety.

Method

Subjects

Male subjects ($n=33$) aged 20–65 years were recruited by an advertisement in a regional daily newspaper. They had to be socially stable, i.e. employed or living on a pension and with a permanent place of residence. They also had to be without physical or psychiatric disorders not associated with excessive alcohol consumption. Furthermore, subjects were not to have received diagnoses of abuse or dependence of substances other than alcohol and nicotine. Their weekly alcohol consumption had to be above 300 grams of pure alcohol. The subjects in the present study have been included in earlier studies of ours (Berggren et al., 2002, 2003) as mentioned in Introduction. It should be emphasized that the personality assessments by using TCI and KSP of these subjects have not been published earlier.

Study design

The individuals were examined physically and psychiatrically using a semi-structured interview by an experienced psychiatrist of an alcoholism treatment unit at an University Hospital. This interview included thorough questioning of the subjects for the presence or absence of the DSM-IV criteria (American Psychiatric Association, 1994) for alcohol dependence occurring at any time during the last year. The subjects had to meet at least three of the seven DSM-IV criteria for alcohol dependence to receive this diagnosis. The subjects were furthermore thoroughly evaluated whether they fulfilled the criteria for type I or II alcoholism (Cloninger et al., 1981, 1996), using the criteria of von Knorring et al. (1985). It has been emphasized that when using subtypes

to classify alcohol-dependent subjects it is important to use DSM-IV or ICD 10 criteria to establish the initial diagnosis of alcohol dependence (Lesch and Walter, 1996). For clarification it should also be noted that there are other typologies of alcohol dependence such as Babor's type A and B (Babor et al., 1992) and Lesch's type I to IV (Lesch and Walter, 1996) but none of these were used in the present study.

Neuroendocrine challenge test procedure

The subjects were currently drinking but were instructed to end their alcohol intake during the day before the fenfluramine challenge test. They were kept fasting after 12.00 p.m. the night before the day of the challenge test. No smoking or alcohol intake was allowed in the morning at the day for the challenge test, which started at 09.00 a.m. The subjects were placed in a supine position and a cannula was inserted into a brachial vein. Blood samples for determination of PRL were collected at the time-point 0 min and every 60 min thereafter for 4 hours. D-fenfluramine hydrochloride (Isomeride[®]) was administered orally in the dose of 30 mg after collection of the blood sample at time 0 min. Light, nontryptophan-containing, caffeine-free snacks were provided during the test period to prevent dehydration and possible hypoglycemic effects of the challenge drug. The blood collected for determination of PRL was centrifuged and serum kept at -70°C until assayed. PRL was analysed by competitive radioimmunoassay using double antibody polyethylene glycol precipitation (Diagnostic Products Corporation, Los Angeles, California). The assay is standardized against the third international standard (World Health Organization 84/500), with 1 g/L of the calibrator preparation corresponding to 32.5 mU/L. The upper reference limit is 300 mU/L for normal men.

Blood samples were collected for determination of carbohydrate deficient transferrin (CDT; upper laboratory reference limit 1.5%) and liver function tests (aspartate aminotransferase (AST), alanine aminotransferase (ALT) and gamma-glutamyltransferase (GGT); upper laboratory reference limit for all tests: 0.8 $\mu\text{Kat/L}$). Determination of narcotic drugs and benzodiazepines in urine samples was also performed using suitable laboratory screening procedures.

Personality assessment

Temperament and Character Inventory (TCI) is a 238-item, true-false self-rating questionnaire (Cloninger et al., 1994). The TCI is designed to assess individual personality along four basic dimensions of temperament: novelty-seeking (NS), harm avoidance (HA), reward dependence (RD) and persistence (P). The

remaining three dimensions in TCI reflect character, which are: self-directedness (SD), cooperativeness (CO) and self transcendence (ST). Each dimension contains of 3–5 sub-dimensions, with an exception of the temperament dimension persistence. In the present study we used the Swedish version of this questionnaire (Brändström et al., 1998).

Karolinska Scales of Personality (KSP) comprises 135 items with a four-point response format grouped in 15 scales (Schalling et al., 1987; Ramklint and Ekselius, 2003). Four scales are related to anxiety proneness (somatic anxiety, psychic anxiety, muscular tension and psychasthenia). Three scales are related to vulnerability to disinhibitory psychopathology (impulsiveness, monotony avoidance and socialisation). Six scales are related to aggressivity and hostility: verbal aggression, indirect aggression, irritability, suspicion, guilt and inhibition of aggression. The remaining two scales are detachment and social desirability.

Psychiatric ratings

An experienced research nurse assessed depressive and anxiety symptoms at the day for the challenge tests (before time 0) using the Hamilton Depression Scale (HDS; total sum of scores ranging from 0–52; Hamilton, 1967) and Hamilton Anxiety Scale (HAS; total sum of scores ranging from 0–56; Hamilton, 1959), respectively.

Present alcohol consumption and tobacco use

During two weeks prior to the D-fenfluramine challenge tests the subjects had to record their daily alcohol consumption on a self-monitoring form called alco-card (for details see Balldin et al., 1994b). They were also requested to estimate for how long time-period (in years) they had had this high level of alcohol consumption. Thereafter the subjects' age at onset of excessive alcohol consumption was calculated and recorded. Excessive alcohol consumption was defined as consuming more than three standard drinks of alcohol (about 40 g of pure alcohol) per day (Miller et al., 2005). Their smoking status was registered, as number of cigarettes used per day. Snuffing (i.e. tucking snuff under the lip) status was registered as amount (grams) of snuff used per day.

Statistics

In the present study all individual raw-data from the two personality tests (TCI and KSP) was transformed into normative *T*-scores (mean: 50; standard deviation: 10). This allows comparisons with a Swedish age and

gender-stratified, non-patient sample for both personality tests (TCI: Brändström et al., 1998; KSP: Schalling et al., 1987; Gustavsson et al., 1997).

For each individual, PRL level at time-point 0 min (i.e. immediately before D-fenfluramine was administered orally) was defined as the baseline PRL level. Maximum PRL responses were calculated as the differences between baseline PRL level and the highest PRL response after D-fenfluramine administration (i.e. the highest PRL level that occurred during the 4 hours of the challenge test). If baseline PRL level was a higher value than any of the following PRL values, maximum PRL response was defined as the differences between lowest PRL level after time 0 and the highest PRL level thereafter.

The data sample was sub-grouped into tobacco users (e.g. snuffers and smokers) and tobacco non-users. T-scores for the two personality tests (TCI and KSP) were compared between these two groups by using independent t-test. By using a median split procedure, the data sample was also sub-grouped into low and high PRL response to D-fenfluramine, and into short and long duration of excessive alcohol consumption (years). Differences in personality profiles for these sub-groups were then analysed with t-test. Significance level of $p < 0.01$ was used.

Predictions of the variables shown to be significant (i.e. years of excessive alcohol consumption, PRL maximum response or use of tobacco, all in relationship to the personality profile) were then tested by help of multiple regression. The significant variables were entered simultaneously as independent continuous data and the personality variables as dependent data.

Results

All individuals ($n = 33$) fulfilled the criteria for alcohol-dependence (DSM-IV) and for type I alcoholism according to the criteria of von Knorring et al. (1985). The mean $\pm$ SD age of the total sample was 51 ± 6 and their body weight was 89 ± 13 kg. The sample scored within the normal range for the Hamilton Depression Scale (3.1 ± 3.6) as well as for the Hamilton Anxiety Scale (6.3 ± 7.1). Levels for the liver enzymes ALT and AST were 0.75 ± 0.53 and 0.52 ± 0.29 μ Kat/L, respectively, and for GGT 1.33 ± 1.20 μ Kat/L. CDT values were $2.11 \pm 1.49\%$. None of the individuals were found to have narcotic drugs or benzodiazepines in the urine samples. The individuals reported an alcohol consumption

of 87 ± 41 grams pure alcohol per day during the last two weeks prior to the challenge tests.

Personality profile

When comparing the mean scores for TCI and KSP in the alcohol-dependent individuals with normative T-scores (mean: 50; standard deviation: 10) all these values were within the range of the normative values (Fig. 1).

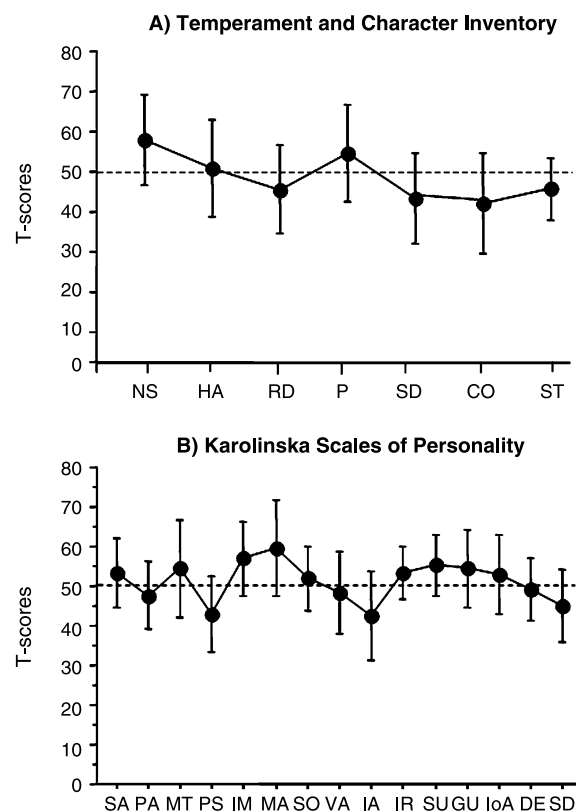


Fig. 1. Mean $\pm$ SD (T-scores) for personality profile, as assessed by the Temperament and Character Inventory (A) and the Karolinska Scales of Personality (B), in 33 male type I alcohol-dependent individuals. The broken lines in the two figures show the mean values for normative T-scores. A NS novelty-seeking, HA harm avoidance, RD reward dependence, P persistence, SD self-directedness, CO cooperativeness, ST self transcendence. B SA somatic anxiety, PA psychic anxiety, MT muscular tension, PS psychasthenia, IM impulsiveness, MA monotony avoidance, SO socialisation, VA verbal aggression, IA indirect aggression, IR irritability, SU suspicion, GU guilt, IoA inhibition of aggression, DE detachment, SD social desirability

Low versus high PRL response

Subjects self-reported via registration on alcohol cards that they had ended their alcohol consumption the day before the D-fenfluramine challenge test. This was also confirmed by negative breath analyzer tests. Furthermore, none of the subjects showed any signs of alcohol withdrawal syndrome. The finding

Table 1. Mean $\pm$ SD (*T*-scores) for personality profile, assessed by the Temperament and Character Inventory and the Karolinska Scales of Personality, in male type I alcohol-dependent individuals with low ($n = 16$) and high ($n = 16$) maximum prolactin responses to D-fenfluramine (30 mg oral dose)

Personality profile	Low responders	High responders
Temperament and Character Inventory		
<i>Temperament dimensions</i>		
Novelty Seeking	56 $\pm$ 11	60 $\pm$ 11
Harm Avoidance	56 $\pm$ 11	46 $\pm$ 11**
Reward Dependence	46 $\pm$ 12	45 $\pm$ 10
Persistence	52 $\pm$ 14	56 $\pm$ 11
<i>Character dimensions</i>		
Self-Directedness	41 $\pm$ 11	45 $\pm$ 11
Cooperativeness	40 $\pm$ 13	44 $\pm$ 12
Self-Transcendence	44 $\pm$ 7	47 $\pm$ 8
Karolinska Scales of Personality		
<i>Anxiety proneness</i>		
Somatic Anxiety	56 $\pm$ 10	51 $\pm$ 7
Psychic Anxiety	49 $\pm$ 8	47 $\pm$ 9
Muscular Tension	57 $\pm$ 16	52 $\pm$ 8
Psychasthenia	51 $\pm$ 9	46 $\pm$ 11
<i>Disinhibitory psychopathology</i>		
Impulsiveness	57 $\pm$ 8	57 $\pm$ 10
Monotony Avoidance	56 $\pm$ 10	62 $\pm$ 14
Socialisation	42 $\pm$ 11	43 $\pm$ 12
<i>Aggressivity and hostility</i>		
Verbal Aggression	57 $\pm$ 6	54 $\pm$ 9
Indirect Aggression	53 $\pm$ 6	53 $\pm$ 7
Irritability	55 $\pm$ 9	54 $\pm$ 11
Suspicion	55 $\pm$ 7	51 $\pm$ 12
Guilt	48 $\pm$ 7	50 $\pm$ 9
Inhibition of Aggression	45 $\pm$ 5	45 $\pm$ 12
<i>Detachment</i>		
Social Desirability	42 $\pm$ 10	44 $\pm$ 10

** $p < 0.01$

that these subjects were able to end their alcohol consumption the day before the challenge test and showed no signs of alcohol withdrawal syndrome at the day of the challenge test is probably explained by that they had not reached the late phase in their course of alcohol dependence, which is predominated by features of physiological withdrawal (Kumar et al., 2005 and references therein).

For the total sample of individuals, the baseline PRL concentration was 135 ± 59 mU/L, and the maximum PRL response was 61 ± 66 mU/L. A median split procedure was used to divide the data sample into two sub-groups (i.e. low and high PRL response; median: 96 mU/L).

Concerning the PRL response to D-fenfluramine, there was a significant difference between low and high PRL responders regarding the TCI dimension of HA ($p < 0.01$), i.e. low PRL responders showed higher values of HA (Table 1). Out of the four subscales of HA, individuals with low PRL response had significantly higher values in the subscale HA4 (i.e. fatiguability and asthenia versus vigor; $p < 0.01$). There were no differences between individuals with low and high PRL response in the other dimensions of the TCI, or in any of the scales of the KSP.

Short versus long duration of excessive alcohol consumption

The total sample of individuals had a late age of onset of excessive alcohol consumption (40 ± 11 years) and their duration of excessive alcohol consumption was 11 ± 9 years. A median split procedure was used to divide the data sample into two sub-groups (i.e. short and long duration of excessive alcohol consumption; median: 9 years).

Individuals with long duration of excessive alcohol consumption had higher values of the dimension HA ($p < 0.001$; see Table 2) and higher values in the subscale HA3 (shyness versus gregariousness, $p < 0.01$).

Table 2. Mean $\pm$ SD (*T*-scores) for personality profile, assessed by the Temperament and Character Inventory and the Karolinska Scales of Personality, in male type I alcohol-dependent individuals with short ($n = 16$) and long ($n = 16$) duration of numbers of years with excessive alcohol consumption

Personality profile	Short duration <9 years	Long duration >9 years
Temperament and Character Inventory		
<i>Temperament dimensions</i>		
Novelty Seeking	60 $\pm$ 12	56 $\pm$ 10
Harm Avoidance	45 $\pm$ 10	57 $\pm$ 10**
Reward Dependence	45 $\pm$ 11	46 $\pm$ 11
Persistence	55 $\pm$ 12	54 $\pm$ 13
<i>Character dimensions</i>		
Self-Directedness	47 $\pm$ 11	39 $\pm$ 10
Cooperativeness	44 $\pm$ 11	39 $\pm$ 14
Self-Transcendence	48 $\pm$ 7	43 $\pm$ 7
Karolinska Scales of Personality		
<i>Anxiety proneness</i>		
Somatic Anxiety	51 $\pm$ 9	57 $\pm$ 8
Psychic Anxiety	44 $\pm$ 8	51 $\pm$ 8
Muscular Tension	54 $\pm$ 14	55 $\pm$ 10
Psychasthenia	45 $\pm$ 11	52 $\pm$ 8
<i>Disinhibitory psychopathology</i>		
Impulsiveness	56 $\pm$ 9	58 $\pm$ 9
Monotony Avoidance	62 $\pm$ 13	57 $\pm$ 10
Socialisation	47 $\pm$ 9	37 $\pm$ 11**
<i>Aggressivity and hostility</i>		
Verbal Aggression	55 $\pm$ 9	56 $\pm$ 6
Indirect Aggression	54 $\pm$ 7	52 $\pm$ 7
Irritability	54 $\pm$ 9	55 $\pm$ 11
Suspicion	50 $\pm$ 9	56 $\pm$ 10
Guilt	50 $\pm$ 9	48 $\pm$ 7
Inhibition of Aggression	44 $\pm$ 11	46 $\pm$ 5
<i>Detachment</i>	51 $\pm$ 7	53 $\pm$ 9
<i>Social Desirability</i>	44 $\pm$ 7	42 $\pm$ 12

** $p < 0.01$

Furthermore, those with long duration of excessive alcohol consumption had lower values in the subscale ST1 (self-forgetful versus self-conscious; $p < 0.01$) of the character dimension self-transcendence. Concerning KSP, the group with long duration of excessive alcohol consumption had lower values in the scale socialisation ($p < 0.01$; Table 2).

Tobacco use versus tobacco non-use

Of the total sample 17 individuals (52%) were tobacco users. Among the tobacco users 10 individuals were smokers (20 ± 11 ciga-

rettes per day) and 7 snuffers (35 ± 4 grams per day).

There was no difference between tobacco users and non-users in any of the dimensions or the subscales of TCI. With respect to KSP, tobacco users had significantly higher value of somatic anxiety ($p < 0.01$; see Table 3).

Predictions of PRL response and years of excessive alcohol consumption to harm avoidance

The results above indicate that individuals with long duration of excessive alcohol

Table 3. Mean $\pm$ SD (*T*-scores) for personality profile, assessed by the Temperament and Character Inventory and the Karolinska Scales of Personality, in tobacco using ($n=16$) and non tobacco using ($n=16$) male type I alcohol-dependent individuals

Personality profile	Tobacco users	Non tobacco users
Temperament and Character Inventory		
<i>Temperament dimensions</i>		
Novelty Seeking	55 $\pm$ 10	61 $\pm$ 12
Harm Avoidance	54 $\pm$ 12	47 $\pm$ 11
Reward Dependence	43 $\pm$ 12	48 $\pm$ 9
Persistence	53 $\pm$ 13	56 $\pm$ 12
<i>Character dimensions</i>		
Self-Directedness	42 $\pm$ 10	44 $\pm$ 2
Cooperativeness	40 $\pm$ 12	44 $\pm$ 13
Self-Transcendence	45 $\pm$ 7	47 $\pm$ 8
Karolinska Scales of Personality		
<i>Anxiety proneness</i>		
Somatic Anxiety	57 $\pm$ 9	50 $\pm$ 7**
Psychic Anxiety	48 $\pm$ 8	47 $\pm$ 9
Muscular Tension	57 $\pm$ 15	51 $\pm$ 8
Psychasthenia	49 $\pm$ 10	47 $\pm$ 11
<i>Disinhibitory psychopathology</i>		
Impulsiveness	58 $\pm$ 9	56 $\pm$ 10
Monotony Avoidance	59 $\pm$ 13	60 $\pm$ 12
Socialisation	39 $\pm$ 10	46 $\pm$ 11
<i>Aggressivity and hostility</i>		
Verbal Aggression	58 $\pm$ 5	53 $\pm$ 9
Indirect Aggression	53 $\pm$ 7	54 $\pm$ 7
Irritability	57 $\pm$ 9	52 $\pm$ 11
Suspicion	53 $\pm$ 9	52 $\pm$ 11
Guilt	48 $\pm$ 8	50 $\pm$ 8
Inhibition of Aggression	44 $\pm$ 9	46 $\pm$ 9
<i>Detachment</i>	53 $\pm$ 8	51 $\pm$ 8
<i>Social Desirability</i>	42 $\pm$ 6	44 $\pm$ 13

** $p < 0.01$

consumption and individuals with low PRL response have significantly higher values of harm avoidance. In order to estimate the magnitude of these significant independent variables in relationship to harm avoidance, multiple regression analysis was performed. When continuous data for years of excessive alcohol consumption and PRL responses were entered simultaneously as independent variables, and harm avoidance as the dependent variable,

the results showed an overall effect ($r = 0.43$; $p < 0.05$). Out of the two independent variables, years of excessive alcohol consumption was the strongest predictor ($p < 0.05$).

Discussion

In the present study we found no difference in personality, as assessed by the TCI and KSP, between male type I alcohol-dependent individuals and Swedish norm groups. This finding is in agreement with that of Weijers et al. (1999) who reported no difference in personality, as assessed by the TCI, between abstinent alcohol-dependent men and controls. It should thus be taken into consideration that there may be groups or populations of alcohol-dependent individuals, especially among those with type I alcoholism, who do not differ from the general population in personality characteristics.

The main objective of the present study was, however, to investigate the association between central serotonergic neurotransmission, as assessed by the PRL response to D-fenfluramine, and personality and particularly the TCI dimension HA in male type I alcohol-dependent individuals. However, since we in earlier studies of ours have found relationships between central serotonergic neurotransmission and the duration of excessive alcohol consumption (Berggren et al., 2002) and tobacco use (Berggren et al., 2003) in male type I alcohol dependent individuals, we also investigated the associations between these two latter variables, and personality in the present subjects.

Concerning central serotonergic neurotransmission individuals with low central serotonergic neurotransmission had higher values of the TCI dimension HA. This finding is in agreement with that of Weijers et al. (2001) reporting an association between low central serotonergic neurotransmission, as assessed by the PRL response to D,L-fenfluramine, and high values of the TCI dimension HA in abstinent alcohol-dependent men. It is

also in agreement with the study of Hennig et al. (2002) reporting this association in healthy controls. Furthermore, in agreement with Hennig et al. (2002) we also found that the association between low central serotonergic neurotransmission and high values of HA was mainly due to higher values in the subscale HA4, i.e. fatigability and asthenia versus vigor. Taken together the findings of these two studies thus suggest an involvement of central serotonergic neurotransmission in the personality trait HA and especially to fatigability and asthenia. In studies of the beta-carbolines harman and nor-harman in alcohol-dependent individuals elevated levels of harman has been found to be associated with high values of self-reported depression and anxiety and elevated levels of nor-harman also to high values of harm-avoidance (Rommelspacher et al., 1996). Thus, apart from reduced central serotonergic neurotransmission high values of harm avoidance may also be related to the anxiogenic/depressiogenic properties of the beta-carbolines harman and nor-harman. Interactions between central serotonergic neurotransmission and these compounds should also be considered (Rommelspacher et al., 1996).

With regard to tobacco use (current smoking or snuffing), tobacco users had higher values in the scale somatic anxiety of the KSP. The relationship between tobacco use and high values of somatic anxiety, which includes experiencing autonomic disturbances, may be due to the increase in sympathetic activity caused by nicotine (Pomerleau and Pomerleau, 1984). In studies of the beta-carbolines harman and nor-harman these compounds have also been reported to be elevated in smokers (Breyer-Pfaff et al., 1996; Rommelspacher et al., 2002) and the high values of somatic anxiety in the tobacco-users may therefore also be related to the anxiogenic properties of these compounds.

Perhaps the most notable finding in the present study was that individuals with long duration of excessive alcohol consumption

differed in one of the dimensions of the TCI and in one of the scales of KSP. It thus appears that long duration of excessive alcohol consumption has an influence on personality, at least in male type I alcohol-dependent individuals. More specifically, these individuals with long duration of excessive alcohol consumption (more than 9 years) had higher values of the TCI dimension HA and in the subscale HA3 (shyness versus gregariousness). This finding questions the stability of the temperament dimensions of the TCI (Cloninger, 1994) and thus suggests that long-term alcohol intake may influence the temperament dimensions of TCI. It may also implicate that the personality trait of high HA described in type I alcoholics may only be present in type I alcoholics with long duration (more than about 9 years) of excessive alcohol consumption. If so, this characteristic personality traits, i.e. high values of harm avoidance or anxiety proneness, of type I alcoholism may be a consequence of rather than preceding type I alcoholism in these individuals. It should, however, be noted that these conclusions are based on cross-sectional findings and should therefore be interpreted with caution and need to be replicated in studies with longitudinal design.

In addition, individuals with long duration of excessive alcohol consumption had lower values of the scale socialisation of the KSP, which deserve some comments. This scale reflects dimensions of alienation, victimisation, resentment and dysphoria and is strongly associated with the clinical severity of personality pathology and maladaptiveness (Ekselius et al., 1994; Svanborg et al., 1999). It may therefore be suggested that long duration of excessive alcohol consumption in male type I alcohol dependent individuals may give raise to severe personality pathology and maladaptiveness.

In pharmacotherapeutical trials using Cloninger's typology no positive results have been found on alcohol intake after treatment with selective serotonin re-uptake inhibitors

(SSRIs) in these subtypes. Thus, in the study of Chick et al. (2004), which included a large number of alcohol dependent individuals ($n = 493$), who were subtyped according to the Cloningers typology, no effect was found on alcohol intake and type II individuals actually had a worse outcome than type I individuals after treatment with the SSRI fluvoxamine. This may be explained by findings from an earlier study of ours using another sample of heavy drinking individuals than in the present study (Berggren et al., 2001). In that study we found, contrary to expectations, that treatment with the SSRI Citalopram had no effect on or even increased alcohol intake in subjects with reduced central serotonergic neurotransmission (Berggren et al., 2001). It may therefore be of importance to evaluate central serotonergic neurotransmission before treatment or pharmacotherapeutical trials with SSRIs in individuals with high alcohol consumption. Subtyping alcohol dependent individuals has thus in earlier studies shown to be associated with treatment outcome (see e.g. Lesch and Walter, 1996).

Finally, limitations of the present study are the relatively low number ($n = 33$) of subjects and the relatively high number of variables studied in the subjects. Furthermore, only male subjects are studied and the findings can therefore not be generalized to females.

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